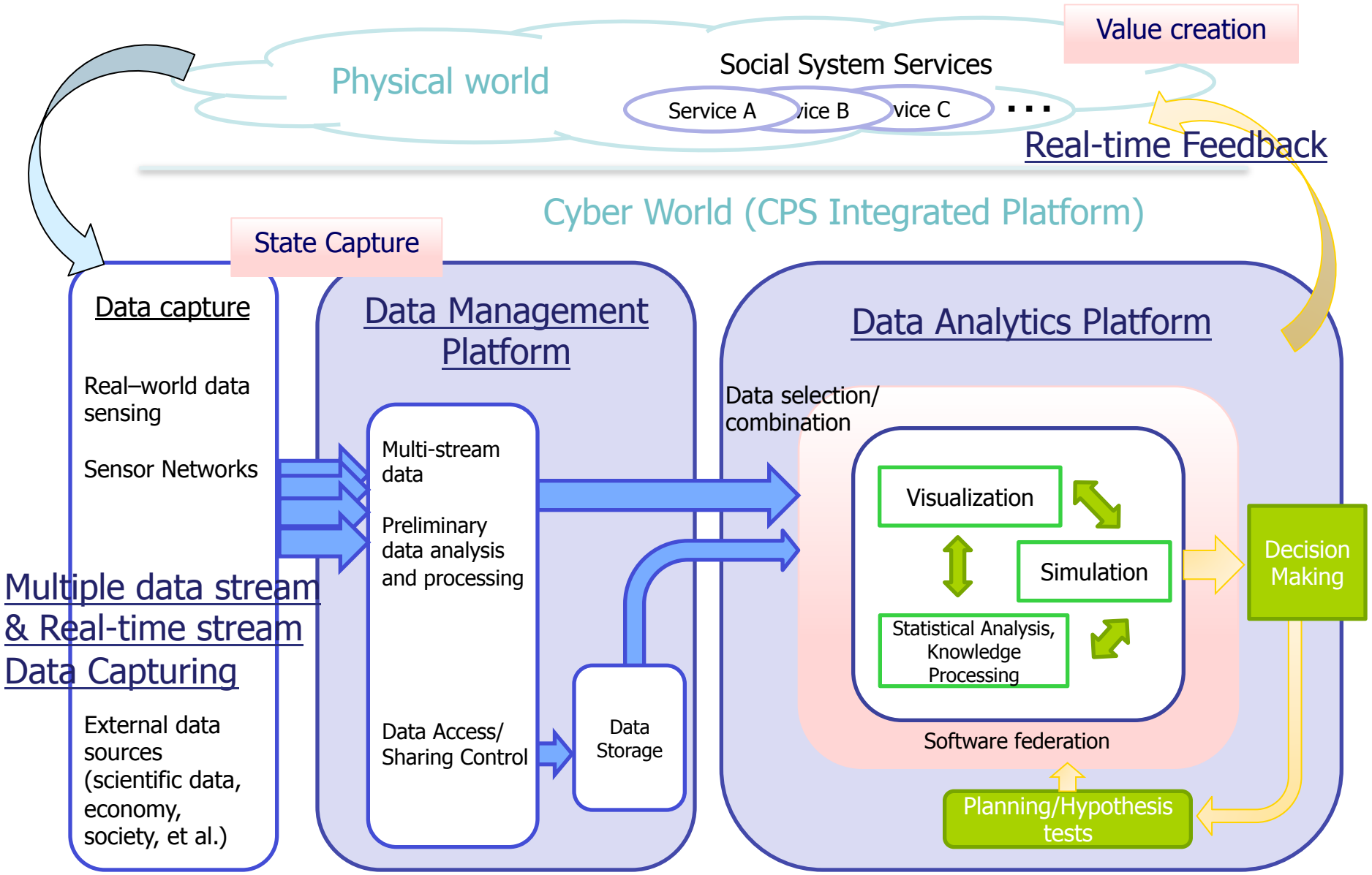
Government Initiatives on CPS in Japan

Yuzuru Tanaka
Meme Media Laboratory
Hokkaido University
N-13, W-8, Sapporo, 060-8628, Japan
tanaka@meme.hokudai.ac.jp

Major Projects

- **CPS Project: MEXT**
  - **CPS-IP: CPS Integrated Platform for Efficient Social Services (09/2012-03/2017):.**
    - **FS (06/2011-03/2012)**
- **CPS-related projects**
  - **MEXT:JSPS**
    - **Info-plosion project (PI: M. Kitsuregawa) (01/2005-03/2011)**
      - **Infrastructure for the Information-explosion Era**
      - **Discovery science, platform systems, testbed system**
      - **Large number of partners mainly from academy**
    - **Info-Energy Generator (PI: M. Kitsuregawa) (FY2010-FY2014)**
      - **FIRST (Funding Program for World Leading Innovative R&D on Science and Technology)**
      - **Development of the Fastest Database Engine for the Exa of Very Large Database and Experiment and Evaluation of Strategic Social Services Embedded by the Database Engine**
  - **METI:NEDO**
    - **R&D and Demonstration Projects for Innovative Social Systems based on the Fusion with Information Technologies (FY2012-)**
      - **Urban Transportation: Usability, Optimal and Disaster-Resistant Service**
      - **Healthcare: human centered secure data management**
      - **Industrial Ecosystem among Agriculture, Commerce, and Engineering**
- **Big Data Project (MEXT: ? FY2013-)**

CPS-IP Platform

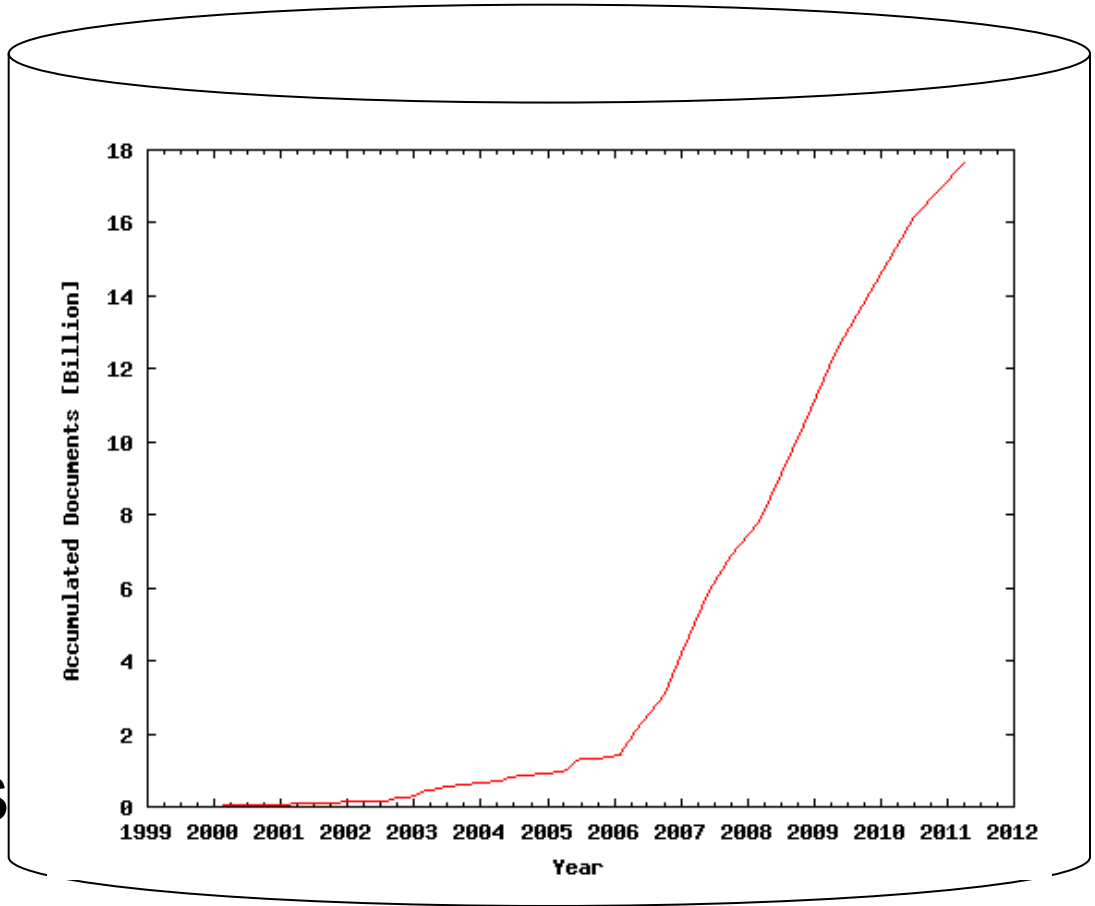


Target Applications of CPS-IP

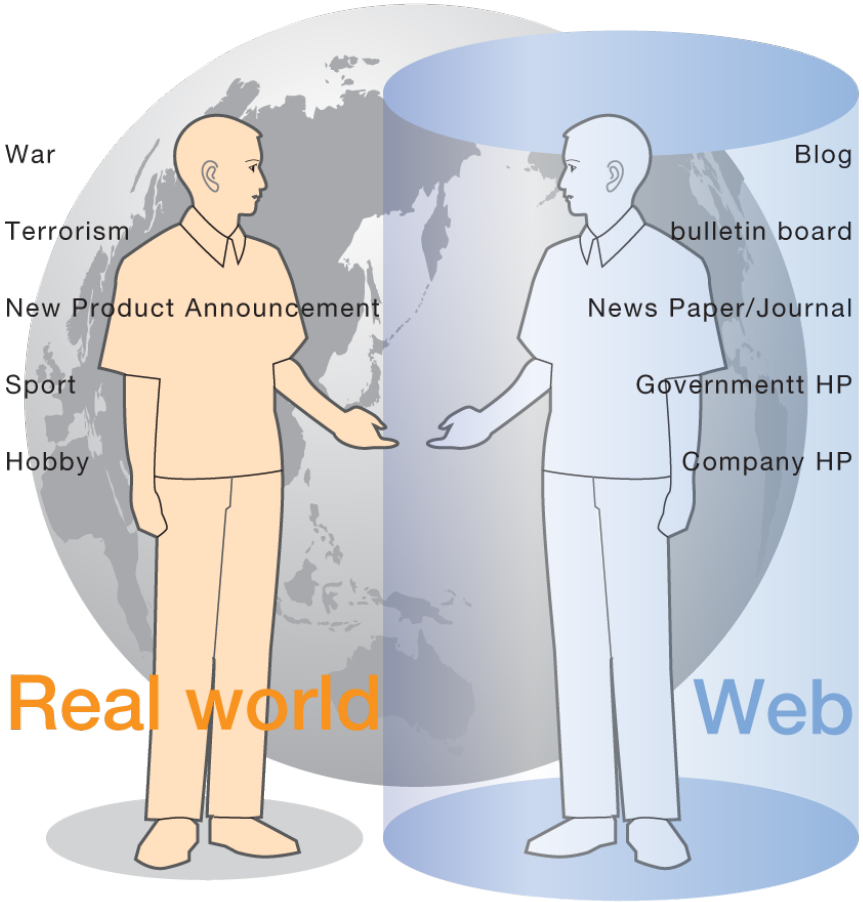
Item	Capture	Data	Analytics	Feedbacks
1. Smart Snow Plowing and Removing	- Behavior sensing of humans and vehicles - Claims analysis - Snow clearance sensing	- Integration of action planning and road info - Management of data archive and real-time info	- Visualization and quantitative analysis of snowfall and clearance - Open smart federation architecture - Software components	- Info dissemination thru SNS to citizens - Snow clearance control
2. ITS & Confluence Management	- Behavior sensing of humans and cars	- Integration with geographic info	- Analysis of behavior, CO_2 reduction, privacy preservation	- Traffic signal control
3. Disaster Management and Response	- Sensing of city activities	- P2P-based sensor data stations integration	- Simulation of city activities	- Social communication supports
4. Energy Saving in Univ. Campus	- Visual sensor - Energy consumption sensors - IC card info	- Cloud-based information sharing of multiple sensing - XML schema for sensor data representation	- Modeling of human and vehicle movement - Power consumption modeling	- Visualization of human behavior - Visualization of personal power consumption

Kitsuregawa's Group: 12 Year Web Archive

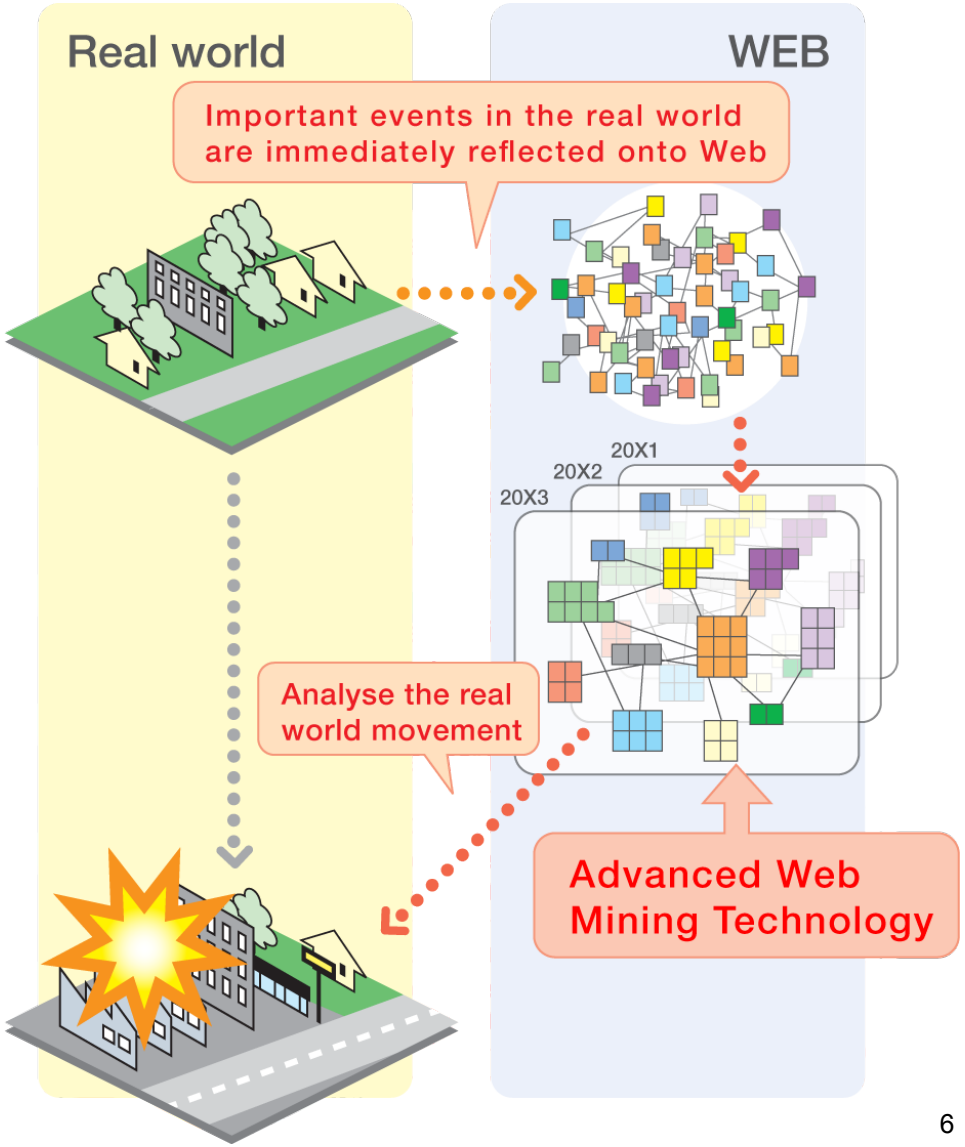
- One of the biggest Web archive in Asia
  - Focused on Japanese pages in any domain (1999～)
- Contents of **18 billion URLs** are stored in total including HTML texts and images (Apr. 2011)
- Blogs and twitters



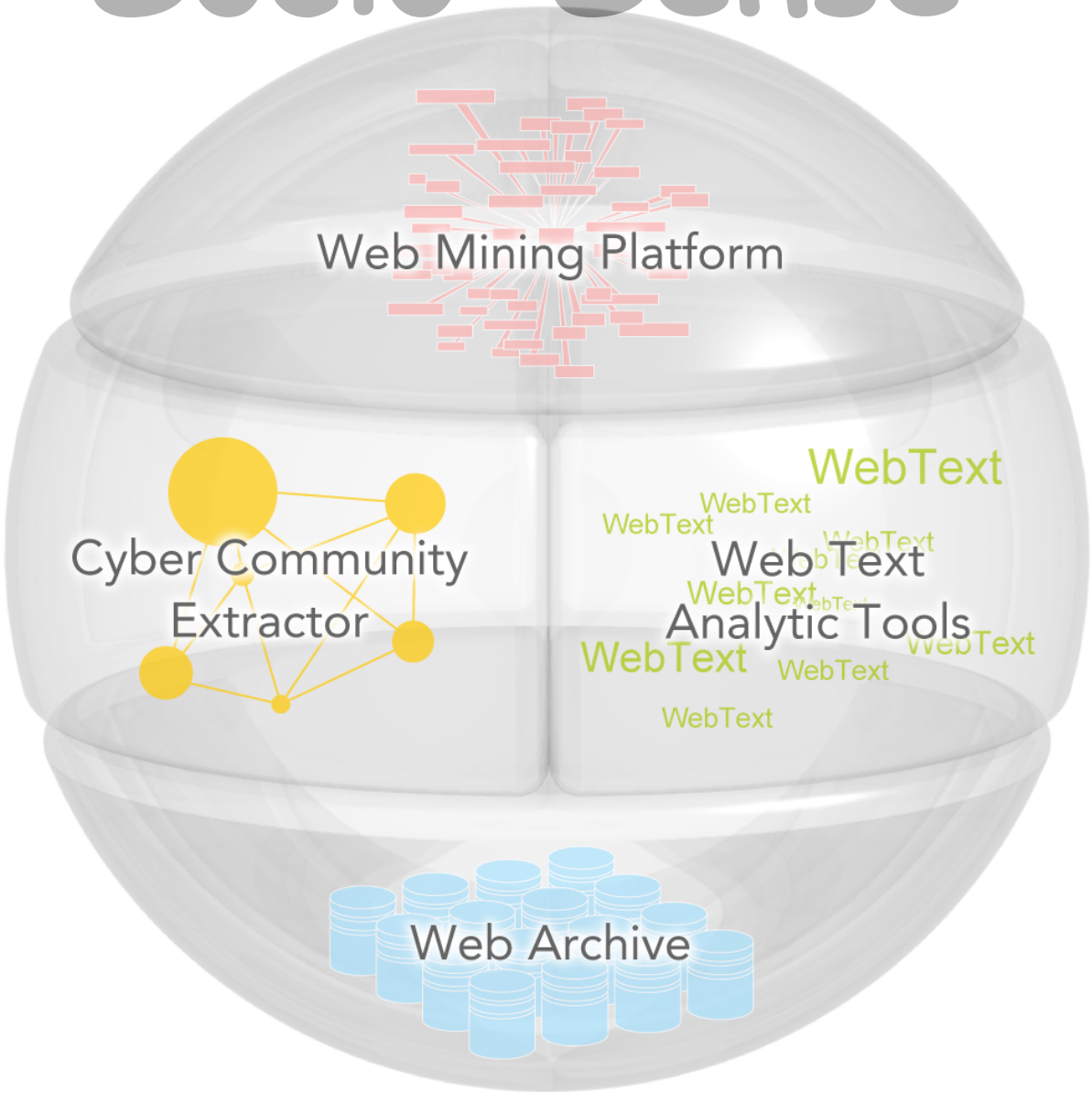
Socio-Sense
(Web is a sensor for Society)



Web is a mirror of the real world



Socio-Sense


Web Mining Platform
Cyber Community Extractor
WebText
WebText
WebText
WebText
WebText Analytic Tools
WebText
WebText
WebText
WebText
Web Archive


Cyber Analytics
(Visual Analytics Environment)

Characteristics of Japanese CPS

- CS initiative, not the initiative of control side.
- Focusing on Social CPS, i.e., Social HCPS.
- HCPS
  - Hs in P
  - H or Hs in the loop
- Going in parallel with Big Data
  - But focusing on
    - Real time data stream and their retrospective data
    - Multimode and multistreams coming from multiple sources (i.e., owned by different owners)
- Aiming at Sustainable and Efficient Social System Services for
  - Energy saving
  - Healthcare
  - Secure and comfortable society
  - Disaster management and response

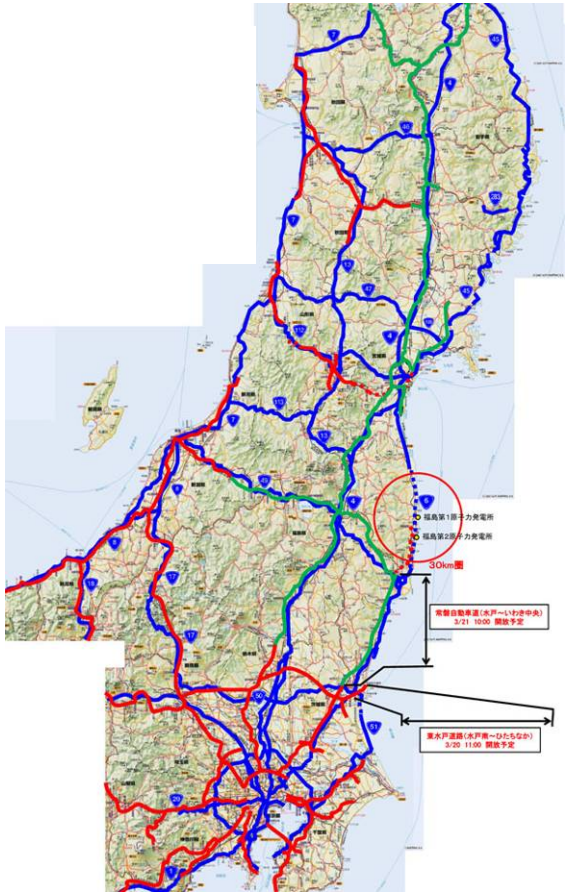
CPS-IP: CPS Integrated Platform for Efficient Social Services

- MEXT Initiated 5 year Project
  - Last year: Feasibility Study Project
  - 09/2012-03/2017
  - $2.5 M for 2012
  - Project Cnsortium
    - NII (National Institute of Informatics)
    - Hokkaido Univ.
    - Osaka Univ.
    - Kyushu Univ.
  - PI: Masao Sakauchi (NII)
- 3 major focused goals out of the following 5 goals of the 4th Science and Technology Basic Plan
  - Health innovation
  - Green Innovation (energy saving and CO_2 reduction)
  - Advanced IT Infrastructure for Science and Technology Innovation
  - Safety and security innovations
  - +Disaster Management and Response (added after 3.11)

An Example of Social System Services

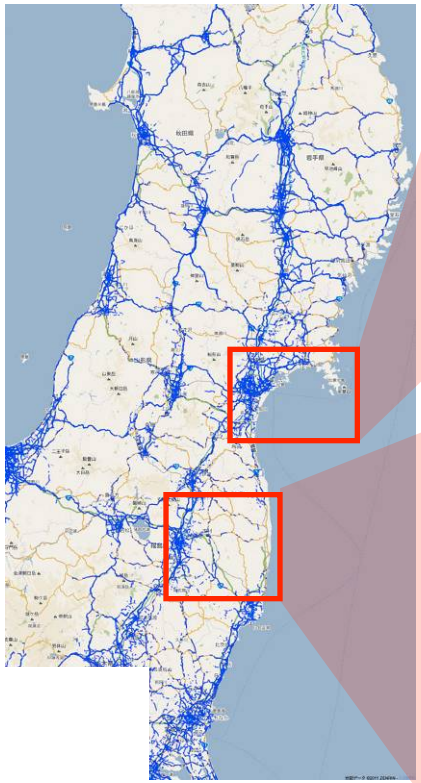
— Online provisioning of travelable road information in the Great East Japan Earthquake —

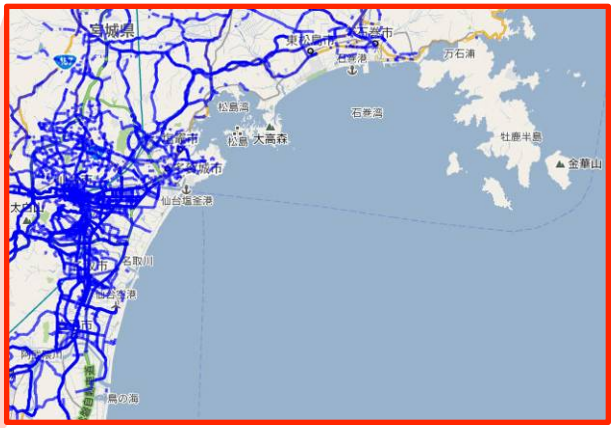
The Minister Commendation awarded for contribution to restoration of the disasters

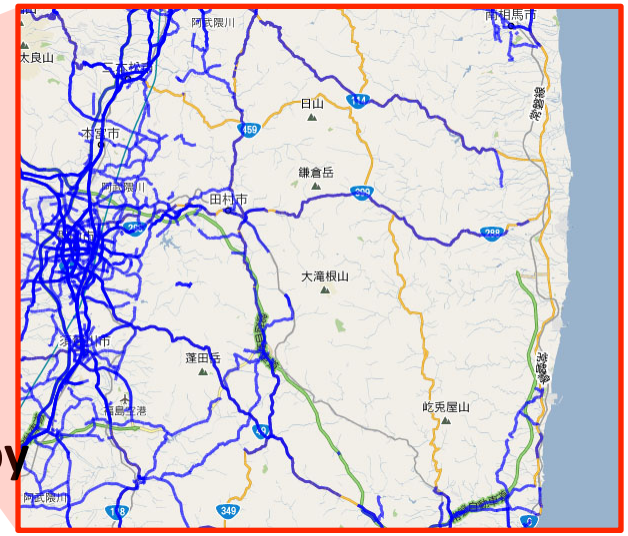


Official road information

The above figure is officially provided on March 20, 2011 by the Ministry of Land, Infrastructure, Transportation and Tourism







Information provided by automobile companies

The real time information of travelable roads as of March 20, 2011 based on vehicle travel information jointly provided by Honda, Pioneer, Toyota and Nissan.

Expected Goals of CPS-IP project

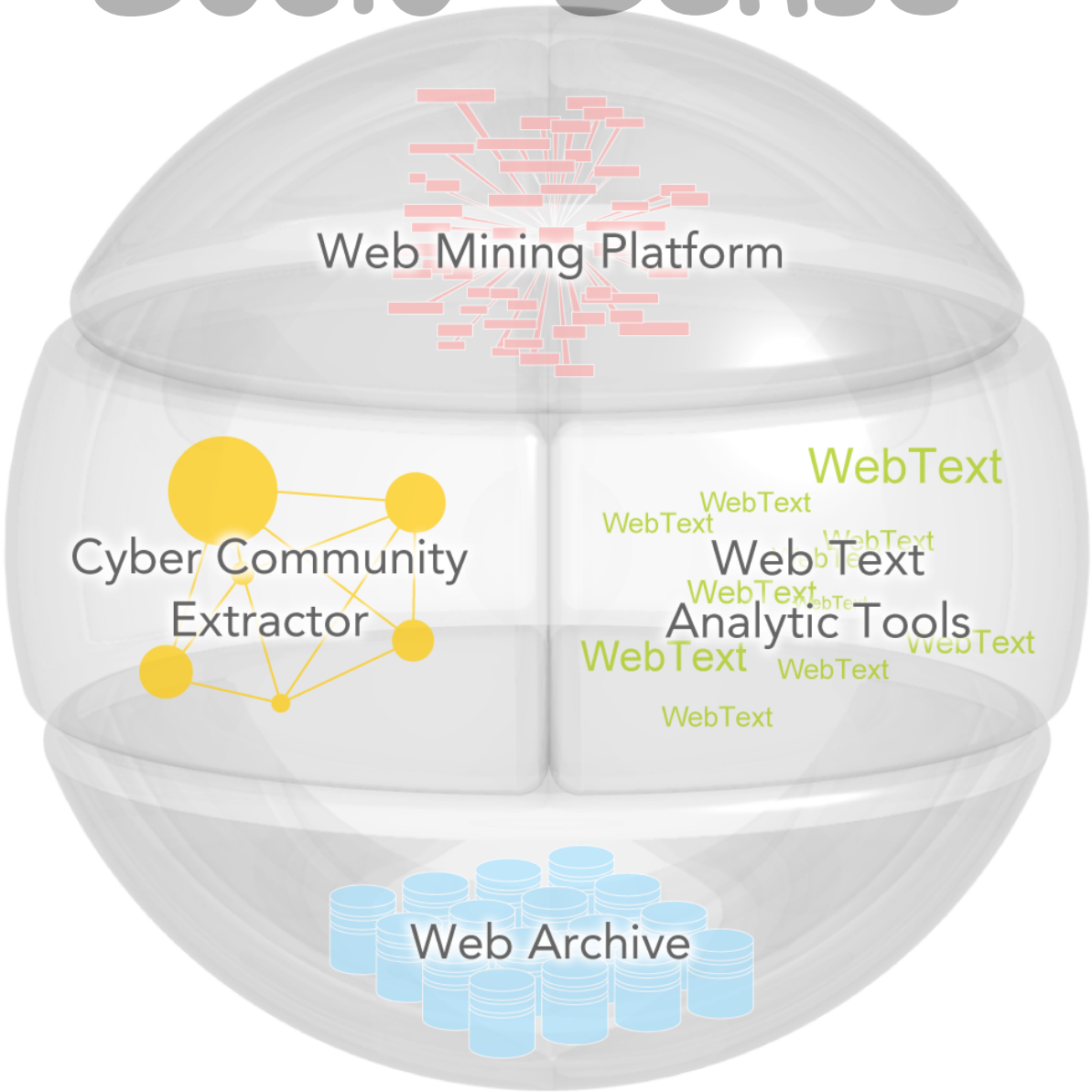
The goals were identified as research challenges and common key technologies through the feasibility study conducted in 2011

- Modeling of complex systems including multi-stream data
  - To develop effective approaches to accomplish optimization of complex systems including multi-stream data in the real-world, such as energy-saving, manufacturing, weather precautions and traffic systems.
- Real-time feedbacks
  - To capture real-time states of social systems by gathering various sensor data,
  - To find the efficient action strategy by quick analysis, and
  - To feed back actions properly to real-world systems and humans
- IT for data analytics platforms
  - Data analytics with statistical and data-mining approaches, induction mechanism and visualization for multi-stream data
  - Organized integration of visualizations and decision-making processes to support decision-making processes and feedbacks
  - Provisioning of components and their reuse of analytics and visualization tools for versatile coordination (Smart federation)
- IT for data management platforms
  - Technologies for effective archive and search for real-time multi-stream data and data archives
  - Technologies for security/privacy preservation for sharing and utilizing real-world data

Real world Data Collection for CPS-IP

Category	Data & source
Location info of vehicles	Probe car data, Taxi probe data
Location info of humans - GPS information - Incoming/outgoing info at stations	Location information from smart phone application Usage information of IC cards in subway passengers
Broadcasting media info	TV program archive of 7 major Tokyo stations of 200k hours for 3 years (150TB)
Student behavior info - IC card usage	Captured in Kyushu Univ. campus
Environmental and weather info	Snowfall, snow clearance from Sapporo city and Japan weather association Real-time weather info from the satellite
Power consumption info	Smart meters in campuses of Kyushu and Osaka Univ.
Communication traffic info	NII's SINET

Socio-Sense


Web Mining Platform
Cyber Community Extractor
WebText
WebText
WebText
WebText
WebText
Analytic Tools
WebText
WebText
WebText
WebText
Web Archive